



## average MW scale storage system price per 30MW in India

How much does a battery storage system cost in India? In another report, the Energy Transitions Commission (ETC) projects that the levelized cost of storage systems in India will reduce from \$0.41 (~INR30.8)/kWh in 2020 to \$0.17 (~INR12.8)/kWh in 2030. The report adopts a two-pronged approach to estimate the cost of Li-ion based MW scale battery storage systems in India. How much would energy storage cost in India by 2030? By 2030, the LCOS for standalone BESS system would be Rs 4.1/kWh and that for co-located system would be Rs 3.8/kWh. This implies that adding diurnal flexibility to ~20-25% of the RE generation would cost an additional Rs 0.7-0.8/kWh by 2030. What is the value of energy storage in India? How would it be dispatched? How much storage is required? How much does a solar system cost in India? The report further states that the additional per-unit cost for a solar project with a storage system in India will be INR1.44/kWh (\$0.02/kWh) in 2020, INR1.02 (\$0.014)/kWh in 2025, and INR0.83 (\$0.01)/kWh in 2030. Are India-specific battery storage cost benchmarks useful? An increasing number of battery storage projects are being built worldwide, and there is significant interest in storage among Indian utilities and policymakers. However, detailed India-specific cost benchmarks that could help utilities design solicitations and assess costs and benefits have been unavailable. How much does a battery cost in India? The report further notes that capital costs for batteries co-located with storage projects in India would fall to \$187 (~INR14,074)/kWh in 2020 and \$92 (~INR6,924)/kWh in 2030. The levelized cost of storage (LCOS) of standalone BESS is estimated to be INR7.12/kWh (~\$0.095/kWh) by 2020, INR5.06/kWh (~\$0.07/kWh) by 2025, and INR4.12/kWh (~\$0.06/kWh) by 2030. How much does a kWh cost in India? In India, the cost of kWh are \$203/kWh in 2020, \$134/kWh in 2025, and \$103/kWh in 2030 (all in real dollars). When co-located with Motivation and context U.S. trends in cost of grid-scale battery storage Methodology for cost estimation in India Key Findings on capital costs, LCOS & tariff adder Shruti Deorah (smdeorah@lbl.gov) Dr. Nikit Abhyankar (NAbhyankar@lbl.gov) Siddharth Arora (siddharth.j.arora@gmail.com) Ashwin Gambhir We use a two-pronged approach to estimate Li-ion battery LCOS / PPA prices in India: Market Based: We scale the most recent US bids and PPA prices (only storage adder component) using appropriate interest rate / financing assumptions We use a two-pronged approach to estimate Li-ion battery LCOS / PPA prices in India: Market Based: We scale the most recent US bids and PPA prices (only storage adder component) using appropriate interest rate / financing assumptions By 2030, the LCOS for standalone BESS system would be Rs 4.1/kWh and that for co-located system would be Rs 3.8/kWh. This implies that adding diurnal flexibility to ~20-25% of the RE generation would cost an additional Rs 0.7-0.8/kWh by 2030. What is the value of energy storage in India? How would In another report, the Energy Transitions Commission (ETC) projects that the levelized cost of storage systems in India will reduce from \$0.41 (~INR30.8)/kWh in 2020 to \$0.17 (~INR12.8)/kWh in 2030. The report adopts a two-pronged approach to estimate the cost of Li-ion based MW scale battery storage maintaining its position as the cheapest form - in terms of \$/kWh - of grid-scale energy storage. Of all countries here compared, costs are cheapest in India, which already hosts a large installed capacity of MW (the 7th largest in the world) with more projects in the pipeline (CEA). It Recent energy storage



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auctions in India reveal record-low prices, with unsubsidized standalone battery storage bids at 2.8 lacs/MW/month and solar+storage bids at 3.1-3.5 INR/kWh Our analysis, based on implied solar and storage costs from these bids and bottom-up global cost estimates, shows that a ~300-400 GWh of battery storage (~10-15% of average daily RE generation) is found to be cost effective by . For low storage hours (up to 6-8 hours or so), batteries are more cost-effective. As hours of storage increase, pumped hydro becomes more cost-effective. Co-located battery storage The Institute for Energy Economics and Financial Analysis (IEEFA) estimates that the capital cost for a 1-MW/4-MWh standalone battery system in India was \$203/kWh in , and is anticipated to decrease to \$134/kWh in , and then further down to \$103/kWh in . Ongoing costs (OPEX) Ongoing Levelized Cost of Storage for Standalone BESS Could The report further states that the additional per-unit cost for a solar project with a storage system in India will be INR1.44/kWh (\$0.02/kWh) in , INR1.02 (\$0.014)/kWh in , and INR0.83 (\$0.01)/kWh in . Figure 1. Recent & projected costs of key grid-scale storage technologies in India, China, & the US maintaining its position as the cheapest form - in terms of \$/kWh - of grid Plummetering Solar+Storage Auction Prices in India Our analysis, based on implied solar and storage costs from these bids and bottom-up global cost estimates, shows that a solar-plus-storage system can deliver 24/7 clean power at over 95% availability for less than 6 INR/kWh. Grid-Scale Battery Storage: Costs, Value, and Regulatory Bottom-up: For battery pack prices, we use global forecasts; For Balance of System (BoS) costs, we scale US benchmark estimates to India using comparison with component level solar PV The Economics of Utility-Scale Battery Storage Solutions3 ???&#; Utility scale battery storage systems are designed to store electricity on a utility scale, for grid stabilization and load balancing, backup supply, etc. These are typically lithium-ion Cost of battery-based energy storage, INR 10.18/kWh Currently, the cost of battery-based energy storage in India is INR 10.18/kWh, as discovered in a SECI auction for 500 MW/ MWh BESS. The government has launched viability gap funding and Production-Linked Cost of BESS system at INR2.20-2.40 crore per MWh: The cost of battery energy storage system (BESS) is anticipated to be in the range of INR2.20-2.40 crore per megawatt-hour (MWh) during -26 for the development of the BESS capacity of

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